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ECONOMIC AND FINANCIAL STANDING OF FARMS IN EUROPEAN UNION COUNTRIES AT VARIOUS LEVELS OF LABOR PRODUCTIVITY

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Abstract

The main purpose of this paper is to depict the economic and financial standing of farms in European Union countries demonstrating various levels of labor productivity. The study was based on the FADN database. Data from 2013-2015 was used. Some results were compared to corresponding figures from 2007-2009. The study population was divided into quartiles by level of net value added per FTE. The division was validated with the ANOVA variance analysis. Afterwards, selected characteristics were calculated to reflect the economic and financial standing of EU farms in 2013-2015, grouped into quartiles. There was a noticeable growth of the average net value added per FTE in the study period. Over the years covered by this study, the size of farms and the scale of farming operations were the drivers of improvement of labor productivity in EU farms. Another factor stimulating the improvement of labor productivity was a greater availability of other productive inputs, i.e. land and capital. The key role of payments for the development of labor productivity and profitability was also noted. Farms demonstrating higher levels of labor productivity were more willing to borrow funds and invest.

Keywords: *European Union, FADN, farms, labor productivity, variance analysis*

JEL classification: *O52, Q14, Q18*

1 Introduction

Just like in non-agricultural sectors of the national economy, the outcomes of farming activities depend on productive inputs (Guth & Smędzik-Ambroży, 2017, p. 248). Changes in and effective use of these resources are an important indicator of the farms' economic situation and enable forecasting the agricultural development (Gołębiewska, 2008, p. 91). One of the key factors providing information on economic development processes is labor productivity. As it grows, it contributes to reducing costs and increasing the supply of cheaper goods and services. Also, by translating into a greater purchasing power, it helps making the society wealthier (Nowak, 2011, p. 136 after: Gołaś & Kozera, 2002). Labor productivity is primarily reflected in per capita incomes; the effective use of productive inputs (including labor) is a fundamental determinant of the agricultural sector's international competitiveness (Baer-Nawrocka & Markiewicz, 2012, p. 14 after: Poczta, 2003).

All around the world, farming incomes are lower than those earned in non-agricultural sectors. As noted by many authors, including Baer-Nawrocka (2015, p. 177-186), despite the implementation of a broad set of intervention instruments under the Common Agricultural Policy (CAP), income disparity continues to be a problem in most European Union (EU) countries, too. What also needs to be remembered is that agriculture continues to be outperformed by other sectors of national economy in terms of labor productivity, as noted by Baer-Nawrocka (2016, p. 506-508).

Labor productivity in the EU agricultural sector varies strongly from one member state to another. Following their accession to the EU, new member states have improved their agricultural labor productivity while many old EU countries have seen their levels of labor productivity decline (for a broader description, see: Nowak, 2011, p. 136-137). Nevertheless, countries with a shorter history of EU membership continue to experience extremely low levels of agricultural labor productivity (Mrówczyńska-Kamińska, 2013, p. 285). The much greater efficiency of labor use in old EU countries is also noted by Gołębiewska (2008, p. 96). The difference between these two groups of countries is caused by many factors, including historical events. In Central and Eastern European (CEE) countries, in the era of centrally planned economies, efficiency was secondary to quantitative objectives. CEE countries realigned their objectives only after the socio-economic transformation (Podstawka, 1999, p. 5, Baer-Nawrocka & Kiryluk 2006, p. 44-45). Today, several CEE countries have been Union members for many years. From that perspective, it may be interesting to answer more than just the question of their membership's impact on farming labor productivity compared to the

corresponding figures recorded in EU-15 countries. What seems equally important is the general economic and financial standing of farms and the relationship, if any, between their outcomes and labor productivity levels. Therefore, the main purpose of this paper is to depict the economic and financial standing of farms in European Union countries demonstrating various levels of labor productivity.

2 Data and Methods

The study was based on the FADN database (Farm Accountancy Data Network, 2018). Data from 2013-2015 was used. Some results were compared to corresponding figures from 2007-2009 (average figures from the above time intervals were analyzed). The study excluded Malta and Cyprus (due to negligible importance of their agricultural sectors) and Croatia (because of the insufficiently long period of Union membership and the inability to make comparisons with 2007-2009 figures).

In the first step, the study population was divided into quartiles by level of net value added per full-time employee (FTE). The division was validated with the use of one-way analysis of variance (ANOVA). The assumption of normal distribution of the variable[3] under consideration was verified with the Shapiro-Wilk test. Because the above assumption was not met, the Kruskal-Wallis ANOVA on ranks (a nonparametric equivalent of the one-way analysis of variance) was performed (Stanisz, 2006, p. 386). Afterwards, basic descriptive statistics of labor productivity were calculated by quartile groups. Also, the values of the variable in two study periods were mapped to a box-plot. The Student's t-test for dependent samples was used to assess the significance of changes in the net value added per FTE over the years covered by the study.

In the next step, selected characteristics were calculated to reflect the economic and financial standing of EU farms in 2013-2015, grouped into quartiles. The analysis of variance was performed to verify whether statistically significant differences exist between mean values of labor profitability and adjusted labor profitability in the groups identified. Depending on whether the assumption of normal distribution in all groups under consideration was met or not, the classic one-way analysis of variance or the Kruskal-Wallis ANOVA on ranks was performed. Afterwards, to identify the pairs of quartiles that differ from one another, the Tukey's post-hoc test or the post-hoc analysis of p values for multiple comparisons was used, respectively.

[3] For a description of ANOVA and its basic assumptions, see Stanisz (2007, p. 337-338).

3 Results and Discussion

The study started by dividing the EU countries into quartiles by net value added per FTE. This was validated with ANOVA. At a high probability level, the test rejected the null hypothesis on the absence of a statistically significant impact of the grouping factor on the characteristic considered (Table 1). A corresponding analysis was performed for data from 2007-2009.

Table 1 **Results of the Kruskal-Wallis ANOVA on ranks for the variable grouping *the net value added per FTE* in farms from EU countries (based on 2013-2015 mean figures)**

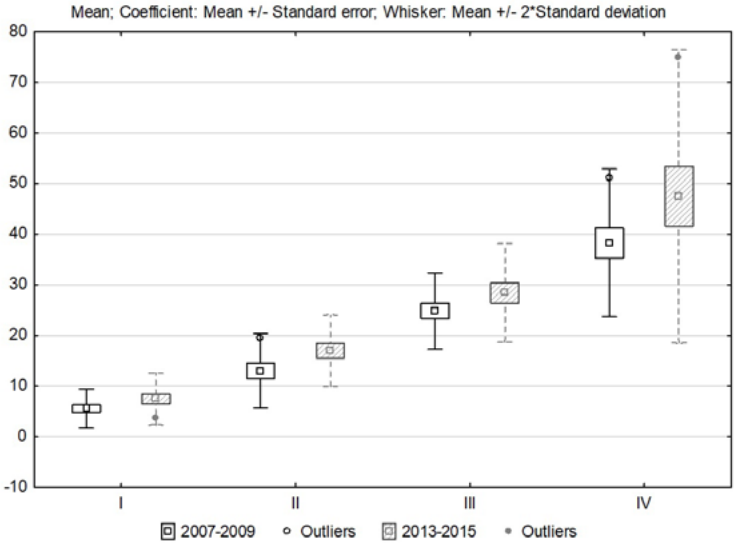
Specification	Test statistic value	p
Kruskal-Wallis ANOVA on ranks	H (3, N = 25) = 22.51385	0.0001

Source: Author's calculations based on Farm Accountancy Data Network, 2018.

The evolution of labor productivity levels in EU farms in 2007-2009 and 2013-2015 is shown in Figure 1 and Table 2. There was a slight change in the composition of the groups between the two periods. In 2013-2015, Slovakian and Irish farms were grouped in higher quartiles than in 2007-2009, whereas an opposite change occurred for Portuguese and Austrian farms. Over the 2013-2015 period, the mean net value added ranged from barely EUR 7,500 per FTE in group 1 to EUR 47,500 in the 4th quartile. There was a noticeable growth of the average net value added per FTE over the study period. The significance of changes in that respect was confirmed with the Student's t-test for dependent samples (the t-test statistic was -4.37 at p = 0.0002). Meanwhile, note that this characteristic extended its range not only in the entire population but also within specific quartiles (except for group 2). As mentioned earlier, slight changes occurred in the composition of quartiles between the study periods. It cannot, however, be ruled out that the disparities in labor productivity between farms in EU countries have widened, reflecting various growth rates of that characteristic. It would appear that the changes are faster in countries with a shorter period of EU membership. This is because in most EU-15 countries, labor productivity does not grow anymore (cf. e.g. Nowak, 2011, p. 130-139). However, as shown by data presented in this paper, intensive changes in that respect were recorded in group 4, composed solely of farms located in old EU countries. Note also the relatively high increase of the coefficient of variation in that quartile (to over 30% in 2013-2015 from slightly above 19% in 2007-2009), reflecting a considerable increase of dispersion of the characteristic. Note that the main reasons for changes in labor productivity

include changes in the level of productive inputs. During the period under consideration, most EU countries (including all CEE countries) experienced a decrease in labor inputs (with the sharpest drops observed in Romania, Slovakia, Slovenia, Czech Republic and Estonia). Meanwhile, in nearly all countries covered by this analysis, the farms recorded an increase in the average net value added per FTE. The highest growth was experienced in countries with the largest reduction in labor inputs, i.e. Bulgaria, Slovakia, Romania and Czech Republic.

Figure 1 **Level of net value added per FTE in EU farms in 2007-2009 and 2013-2015 by quartile groups (EUR thousand/AWU)**



Source: Author's calculations based on Farm Accountancy Data Network, 2018.

Table 3 shows the mean level of selected characteristics of the economic and financial standing of EU farms in 2013-2015 by quartile groups. In group 2*, the information excludes Slovakian farms because of their outlying results which could considerably distort the inference process. Many values were converted into AWU (Annual Work Unit) or FWU (Family Work Unit). Both units are equivalent to 2120 hours of work per year (Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej – Państwowy Instytut Badawczy, 2016, p. 4, 7).

Over the years covered by this study, the size of farms (meaning both the utilized agricultural area and economic size) and the scale of farming operations were the drivers of improvement of labor productivity in EU farms. The mean utilized area was 31 ha and over 86 ha in group 1 and group 4, respectively. The

largest mean utilized area was recorded in group 2 as it included Slovakian and Czech farms. Even larger disparities existed between farms grouped in the extreme quartiles when it comes to economic size and production value: the levels reported in group 4 were around ten times higher than in group 1. Another factor stimulating the improvement of labor productivity was a greater availability of other productive inputs, i.e. land and capital. Extremely large differences existed between the groups as regards the ratio of fixed assets to FTEs. In the 1st quartile group, it was over EUR 61,000 per AWU, gradually increasing two or three times from one quartile to another (Table 3).

Table 2 **Basic descriptive statistics for the variable grouping *the net value added per FTE* in EU farms in 2007-2009 and 2013-2015 by quartile groups (EUR thousand/AWU)**

Specification	Minimum	Mean	Maximum	Coefficient of variation (%)
2007-2009				
Group 1 (ROU, BGR, SVN, POL, SVK, LVA, LTU)	3.0	5.5	8.2	34.9
Group 2 (POR, EST, ELL, CZE, HUN, IRE)	8.2	13.0	19.4	28.3
Group 3 (ESP, ITA, OST, SUO, FRA, SVE)	21.5	24.8	29.9	15.2
Group 4 (DEU, LUX, UKI, BEL, NED, DAN)	30.9	38.3	51.1	19.1
2013-2015				
Group 1 (SVN, ROU, POL, LTU, BGR, LVA, POR)	3.5	7.4	11.2	34.4
Group 2 (ELL, SVK, EST, HUN, OST, CZE)	12.2	16.9	21.1	20.9
Group 3 (ESP, IRE, SUO, ITA, FRA, SVE)	23.0	28.4	35.9	17.1
Group 4 (UKI, LUX, DEU, BEL, NED, DAN)	37.3	47.5	74.9	30.5

Source: Author's calculations based on Farm Accountancy Data Network, 2018.

As shown in Table 3, farms with higher levels of labor productivity demonstrated higher profitability of own labor. The average family farming income per full-time family employee was EUR 7,300 per FWU in group 1, gradually

increasing from one quartile to another. The differences between the groups in that respect were proven to be statistically significant with the one-way ANOVA analysis of variance (F = 26.73 at p = 0.00). Based on the Tukey's test, only the 2nd and 3rd quartile were found not to demonstrate statistically significant differences between them. A statistically confirmed relationship between labor productivity and labor profitability was also reported for instance by Kołoszko-Chomentowska (2016, p. 451-452) who performed a study on Polish farms of specific agricultural types. However, she also noted that the above relationship was not obvious; in some cases, high profitability levels might not be accompanied by high productivity. Similar conclusions were drawn by Sobczyński (2010, p. 247-248) whose study confirmed a strong correlation between these categories. However, his analysis was also extended to the profitability of labor less the balance of operating and investment subsidies and taxes. Generally, no relationship was found between adjusted profitability and productivity. Therefore, Sobczyński concluded that the key driver of the farmers' behavior was the CAP support system rather than the improvement in labor productivity rates. Based on the methodology proposed by Sobczyński (2010, p. 247-248), the ANOVA procedure was repeated. However, this time, the adjusted profitability of unpaid labor was taken into consideration. As the variable did not follow a normal distribution in some groups, the Kruskal-Wallis ANOVA on ranks was used, and demonstrated the absence of any significant impact of labor productivity levels on profitability (H (3, N = 25) = 2.37 at p = 0.50). The key role of financial support for farms in the study period is also confirmed by the level of adjusted net value added per FTE which was barely two thirds of the non-adjusted variable in group 4 and around one third in other quartiles (Tables 2 and 3). Similar conclusions emerge from the analysis of the payments-to-incomes ratio, especially with respect to operating subsidies. Without subventions, farms classed in group 2 and 3 would generate a negative family farming income. In the extreme quartiles, the profitability of own labor would be positive but much lower than the actual figures which include subsidies. The key role of payments for the development of labor productivity and profitability was also emphasized by many authors, including Gołaś (2010, p. 40) who performed an exemplary factor analysis and a regression analysis for the Polish agriculture.

Table 3 **Selected characteristics of the farms' economic and financial standing in EU countries in 2013-2015, grouped into quartiles**

Specification	Group				
	1	2	2*	3	4
Economic size (EUR)	27.9	156.3	94.1	102.9	285.1

Specification	Group				
	1	2	2*	3	4
Utilized agricultural area (ha)	31.0	160.0	84.6	60.6	86.3
Technical equipment of labor (EUR thousand/AWU)	61.1	108.3	119.8	346.4	668.1
Utilized agricultural area per AWU (ha/AWU)	17.1	33.9	32.4	40.7	42.4
Production value (EUR thousand)	32.8	196.2	117.2	119.0	314.5
Adjusted net value added per AWU (EUR thousand/AWU)	2.7	5.7	6.4	10.2	29.1
Family farming income per FWU (EUR thousand/FWU)	7.3	21.1	20.8	22.2	36.9
Adjusted family farming income per FWU (EUR thousand/FWU)	0.8	-34.8	-7.0	-1.5	7.9
Debt ratio (%)	12.1	19.5	18.0	17.7	29.4
Gross investments per AWU (EUR thousand/AWU)	4.4	8.8	8.9	12.5	28.9
Net investments per AWU (EUR thousand/AWU)	1.0	2.0	2.2	0.9	8.4
Share of operating subsidies in incomes (%)	87.8	252.0	129.3	126.2	76.1
Share of all subsidies in incomes (%)	98.1	267.9	136.6	128.3	83.6

* Excluding Slovakia
Source: Author's calculations based on Farm Accountancy Data Network, 2018.

Note that farms with higher levels of labor productivity were more willing to borrow funds, as demonstrated by the share of debts in their assets (in the 1st quartile group: 12% approximately; in the 4th quartile group: over 17 percentage points more). It seems that higher levels of labor productivity were also a driver of investments; indeed, the ratio of gross investments per FTE was increasing in each subsequent group, reaching almost EUR 30,000 per AWU in the 4th quartile. Except for the 3rd quartile, that pattern was also observed when it comes to reproduction which reached the highest level in the last quartile group, as demonstrated by the value of net investments per FTE (Table 3).

4 Conclusion

The main purpose of this paper was to depict the economic and financial standing of farms in European Union countries demonstrating various levels of labor productivity. Based on this study, a statistically significant growth of the average net value added per FTE was observed between the 2007-2009 and 2013-2015 periods. Also, there was an increase in disparities regarding farm labor productivity levels in countries covered by the analysis. Meanwhile, no significant changes were reported in the countries' ranking by net value added per farm FTE. This means there was no trend towards reducing the disparities in labor productivity levels in the study period.

Farms with higher levels of labor productivity usually had a greater economic size, larger utilized agricultural area and greater production scale. Also, they demonstrated better ratios between productive inputs.

This study confirmed the existence of a statistically significant relationship between labor productivity levels and profitability of own labor. However, upon deducting the balance of operating and investment subsidies and taxes from the family farming income, its relationship with labor productivity levels proved to be statistically insignificant. This suggests the subsidies are a crucial determinant of own labor productivity levels. Similar conclusions also emerge from the analysis of the payments-to-incomes ratio, especially as regards operating subsidies.

Farmers reporting higher levels of net value added per FTE demonstrated less conservative attitudes, as confirmed by greater debt ratios and a larger investment scale.

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References

1. BAER-NAWROCKA, A., MARKIEWICZ, N. (2012). Procesy konwergencji/dywergencji w zakresie wydajności pracy w rolnictwie Unii Europejskiej – analiza regionalna. *Journal of Agribusiness and Rural Development*, no. 3(25), p. 13-23.
2. BAER-NAWROCKA, A. (2015). Kwestia parytetu dochodów rolniczych w krajach Unii Europejskiej. In A. Czyżewski, B. Klepacki (Eds.), *Problemy roz-*

woju rolnictwa i gospodarki żywnościowej w pierwszej dekadzie członkostwa w Unii Europejskiej. Tom IX (pp. 177-186). Warszawa: Wydawnictwo PTE.

3. BAER-NAWROCKA, A. (2016). The role of agriculture in the national economy of EU countries. *Journal of Agribusiness and Rural Development*, no. 4(42), p. 501-510.
4. BAER-NAWROCKA, A., KIRYLUK, E. (2006). Efektywność wytwarzania w rolnictwie polskim i w rolnictwie nowych krajów członkowskich Unii Europejskiej z Europy Środkowej i Wschodniej. In S. Urban (Ed.), *Agrobiznes 2006. Konkurencja w agrobiznesie – jej uwarunkowania i następstwa, Prace Naukowe Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, nr 1118, Tom 1* (pp. 44-50). Wrocław: Wydawnictwo UE.
5. FARM ACCOUNTANCY DATA NETWORK. (2018). Retrieved January 17, 2018. from http://ec.europa.eu/agriculture/rica/database/database_en.cfm.
6. GOŁAŚ, Z. (2010). Wydajność i dochodowość pracy w rolnictwie w świetle rachunków ekonomicznych dla rolnictwa. *Zagadnienia Ekonomiki Rolnej*, No. 3, p. 19-42.
7. GOŁAŚ, Z., KOZERA, M. (2002). Strukturalne uwarunkowania wydajności pracy w indywidualnych gospodarstwach rolnych. *Zagadnienia Ekonomiki Rolnej*, no. 4-5, p. 25-44.
8. GOŁĘBIEWSKA, B. (2008). Zróżnicowanie wykorzystania zasobów produkcyjnych w rolnictwie krajów UE. *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu*, vol. X, issue 1, p. 91-96.
9. GUTH, M., SMĘDZIK-AMBROŻY, K. (2017). Agricultural resources in regions of the European Union (attempt to assess the differences and consistency). In JEDLIČKA, P., MAREŠOVÁ, P., SOUKAL, I. (Eds.), *Hradec Economic Days: Double-blind peer reviewed proceedings of the International Scientific Conference Hradec Economic Days 2017, January 31st and February 1st, 2017, Hradec Králové, Czech Republic* (pp. 248-254). Hradec Králové, Czech Republic: University of Hradec Králové.
10. Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej – Państwowy Instytut Badawczy (2016). Wyniki Standardowe 2015 uzyskane przez gospodarstwa rolne uczestniczące w Polskim FADN. Część I. Wyniki Standardowe. Warszawa: Retrieved from https://fadn.pl/wp-content/uploads/2015/12/SRwaz_2015_www.pdf.
11. KOŁOSZKO-CHOMENTOWSKA, Z. (2016). Managing sustainable development of agriculture – case of Poland. In I. Zentková (Ed.), *International Scientific Days 2016 The Agri-Food Value Chain: Challenges for Natural Resources Management and Society, May 19-20, 2016 Nitra, Slovak Republic* (pp. 447-454). Nitra, Slovak Republic: FEM SUA in Nitra.

12. MRÓWCZYŃSKA-KAMIŃSKA, A. (2013). Wydajność pracy w gospodarce żywnościowej w krajach Unii Europejskiej. *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu*, vol. XV, issue 4, p. 285-291.
13. NOWAK, A. (2011). Zmiany wydajności rolnictwa Polski i innych krajów Unii Europejskiej. *Zeszyty Naukowe SGGW w Warszawie. Problemy Rolnictwa Światowego*, vol. 11(26), issue 1, p. 130-139.
14. POCZTA, W. (2003). *Rolnictwo polskie w przededniu integracji z Unią Europejską*. Poznań: Wydawnictwo AR.
15. PODSTAWKA, M. (1999). *Finanse w rolnictwie*. Warszawa: Wydawnictwo Wieś Jutra.
16. SOBCZYŃSKI, T. (2010). Wydajność pracy a poziom wsparcia gospodarstw rolniczych w Polsce na tle UE. *Roczniki Nauk Rolniczych. Seria G*, vol. 97, issue 3, p. 244-257.
17. STANISZ, A. (2006). *Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny. Tom 1. Statystyki podstawowe*. Kraków: StatSoft.
18. STANISZ, A. (2007). *Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny. Tom 2. Modele liniowe i nieliniowe*. Kraków: StatSoft.